

DAFTAR PUSTAKA

- Aanas, M., Z. Muhlisin, Z. Bachrudin, dan L. M. Yusiati. 2020. In vitro gas production kinetics as influenced by the combination of *Leucaenaleucocephala*, *Swietenia mahogani*, and *Artocarpus heterophyllus* as a tannin source. *International Conference: Improving Tropical Animal Production for Food Security*. 465(2020): 1-2.
- Abdollahi, M. dan A. F. Behboudi. 2014. *Encyclopedia of Toxicology (Third Edition)*. Elsevier. Amsterdam.
- Agu, P. C., C. A. Afiukwa, O. U. Orji, E. M. Ezech, I. H. Ofoke, C. O. Ogbu, E. I. Ugwuja, dan P. M. Aja. 2023. Molecular docking as a tool for the discovery of molecular targets of nutraceuticals in diseases management. *Science Reports*. 2025(13): 13398.
- Anas, M. A. 2015. Penambahan tanaman pakan sumber tannin sebagai agensia penghambat produksi metana ternak domba secara in vitro. Skripsi. Universitas Gadjah Mada, Yogyakarta.
- AOAC. 2005. *Official Methods of Analysis (18th edition)*. Association of Official Analytical. Chemists International. USA.
- Assakur, M. 2013. Degradasi Bahan Kering, Nilai pH dan Produksi Gas Sistem Rumen In vitro Terhadap kulit Buah Kakao (*Theobroma cacao*) yang Diberi Perlakuan berbeda. Skripsi. Fakultas Peternakan Universitas Hassanudin. Makassar.
- Castillo-Gonzales, A. R., M. E. Burrola-Barraza, J. Dominguez-Viveros, dan A. Chavez-Martinez. 2014. Rumen microorganism and fermentation. *Archivos de Medicina Veterinaria*. 46: 349-361.
- Chaney, A. L. dan E. P. Marbach. 1962. Modified reagents for determination of urea and ammonia. *Clinical Chemistry*. 8: 130-132.
- Claveria-Gimeno, R., S. Vega, O. Abian, A. Velazquez-Campoy. 2017. A look at ligand binding thermodynamics in drug discovery. *Expert Opinion on Drug Discovery*. 12(4): 363-377.
- Cottyn, B. G. dan C. H. V. Boucque. 1968. Rapid method for the gas-chromatographic determination of volatile fatty acids in rumen fluid. *Journal of Agricultural and Food Chemistry*. 16(1): 105-107.
- Diaz, A., M. Avendro, dan A. Escobar. 1993. Evaluation of sapindus saponaria as a defaunating agent and its effects on different ruminal digestion parameters. *Livestock research for Rural Development*. 5(2): 1-6.
- Dijkstra, J., A. Bannink, J. France, E. Kebreab, dan S. Van Gastelen. 2018. Short communication: Antimethanogenic effects of 3-nitrooxypropanol

- depend on supplementation dose, dietary fiber content, and cattle type. American Dairy Science Association. 1(8): 9041-9042.
- Duin, E. C., T. Wagner, S. Shima, D. Prakash, B. Cronin, R. David, S. Duval, R. Rumbeli, R. T. Stemmler, R. K. Thauer, dan M. Kindermann. 2016. Mode of action uncovered for the specific reduction of methane emissions from ruminants by the small molecule 3-nitrooxypropanol. PNAS. 113(22): 6172-6173.
- FAO. 2013. Tackling Climate through Livestock: A Global Assessment of Emissions and Mitigation Opportunities. Rome. FAO.
- FAO. 2017. Livestock Solutions for Climate Change. Rome. FAO.
- Filipek, J. dan R. Dvorak. 2009. Determination of the volatile fatty acids content in the rumen liquid: comparison of gas chromatography and capillary isotachopheresis. Acta Veterinaria Brno. 78: 627-633.
- Gerber, P. J., H. Steinfeld, B. Henderson, A. Mottet, C. Opio, J. Dijkman, A. Falcucci, dan G. Tempio. 2013. Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities. Food and Agriculture Organization of the United Nations (FAO). Rome.
- Hartadi, H., A. D. Tillman, dan S. Reksohadiprojo. 1990. Tabel Komposisi Pakan untuk Indonesia. Gadjah Mada University Press. Yogyakarta.
- Heilig, G. K. 1994. The greenhouse gas methane (CH₄): sources and sinks, the impact of population growth, possible interventions. Population and Environment: A Journal of Interdisciplinary Studies. 16(2): 109-137.
- Hidayah, N. 2016. Pemanfaatan senyawa metabolit sekunder tanaman (tanin dan saponin) dalam mengurangi emisi metana ternak ruminansia. Jurnal Sains Peternakan Indonesia. 11(2): 89-98.
- Hill, J., C. McSweeney, A. G. Wright, G. Bishop-Hurley, dan K. Kalantar-zadeh. 2016. Measuring methane production from ruminants. Trends in Biotechnology. 34(1): 26-35.
- Holmes, D. E., L. Giloteaux, R. Orellana, K. H. Williams, M. J. Robbins, dan D. R. Lovley. 2014. Methane production from protozoan endosymbionts following stimulation of microbial metabolism within subsurface sediments. Frontiers in Microbiology. 6(5):1-9.
- Islami, H. 2018. Prarancangan pabrik nitrogliserin dari gliserin dan asam nitrat menggunakan proses biazzi dengan katalis asam sulfat kapasitas produksi 10.000 ton/tahun. Jurnal Tugas Akhir Teknik Kimia. 1(2): 1-10.
- Jayanegara, A. dan A. Sofyan. 2008. Penentuan aktivitas biologis tanin beberapa hijauan secara in vitro menggunakan 'hohenheim gas test'

- dengan polietilen glikol sebagai determinan. *Media Peternakan*. 31(1): 44-52
- Kelly, W. J., R. I. Mackie, G. T. Attwood, P. H. Janssen, T. A. McAllister, dan S. C. Leahy. 2022. Hydrogen and formate production and utilisation in the rumen and the human colon. *Animal Microbiome*. 4(2): 1-8.
- Key, N. dan G. Tallard. 2012. Mitigating methane emissions from livestock: a global analysis of sector policies. *Climatic Change*. 112: 387-414.
- Khattab, M. S. A. 2017. Mathematical prediction equations of methane emission from dairy cattle. *Science International Journal*. 5(4):133-141.
- Kingston-Smith, A. H., A. H. Marshall, dan J. M. Moorby. 2012. Breeding for genetic improvement of forage plants in relation to increasing animal production with reduced environmental footprint. *Animal*. 1:1-10.
- Króliczewska, B., E. Pecka-Kielb, dan J. Bujok. 2023. Strategies used to reduce methane emissions from ruminants: controversies and issues. *Agriculture*. 13(3): 1-26.
- Kurniawati, A. 2007. Teknik produksi gas in-vitro untuk evaluasi pakan ternak: volume produksi gas dan pencernaan bahan pakan. *Jurnal Ilmiah Aplikasi Isotop dan Radiasi*. 3(1): 40-49.
- Leahy, S. C., W. J. Kelly, D. Li, Y. Li, E. Altermann, S. C. Lambie, F. Cox, dan G. T. Attwood. 2013. The complete genome sequence of *Methanobrevibacter* sp. AbM4. *Standards in Genomic Sciences*. 8: 215-227,
- Leng, R.A. 1985. Principle and Practice of Feeding Tropical Crop and By Product to Ruminant. Department of Biochemistry and Nutritional University of England. Armidale.
- Ma, X., S. E. Räisänen, M. E. Garcia-Ascolani, M. Bobkov, T. He, M. Z. Islam, Y. Li, R. Peng, M. Raichenbach, A. M. Serviento, E. Soussan, X. Sun, K. Wang, S. Yang, Z. Zeng, dan M. Niu. 2024. Effects of 3-nitrooxypropanol (Bovaer10) and whole cottonseed on milk production and enteric methane emissions from dairy cows under Swiss management conditions. *Journal of Dairy Science*. 107(9): 6817-6833.
- MacCracken, M. C. 2001. Global Warming: A Science Overview. In: Kursunoglu, B. N., S. L. Mintz, and A. Perlmutter. (eds) *Global Warming and Energy Policy*. Boston. Springer.
- Majewska, M. P., R. Miltko, G. Bełżeczki, A. Kędzierska, dan B. Kowalik. 2020. Protozoa population and carbohydrate fermentation in sheep fed diet with different plant additives. *Animal Bioscience*. 34(7): 1146-1156.

- McDonald, P., R.A. Edwards, J.F.D. Greeshalgh, dan C.A. Morgan. 2002. *Animal Nutrition Sixth Edition*. Pearson Education Limited. England.
- Marco-Contelles, J. 2023. The synthesis of 3-nitrooxypropanol, a methane mitigant for sustainable farming with environmental impact: a review. *Synthesis*. 55(14): 2109-2117.
- Martin, C., D.P. Morgavi, dan M. Doreau. 2010. Methane mitigation in ruminants: from microbe to the farm scale. *Animal*. 4: 351-365.
- Menke, K. H. dan H. Steinngas. 1988. Estimation of energetic feed value obtained from chemical analysis and in vitro gas production using rumen fluid. *Animal Research and Development*. 28: 7-55.
- Moss, A. R, J. P. Jouany, dan J. Newbold. 2000. Methane production by ruminants: its contribution to global warming. *Annales de Zootechnie*. 49(2000): 231-253.
- Ness, S. L. dan A. Steiner. 2017. Postoperative Management. In: *Farm Animal Surgery (Second Edition)*. Elsevier. Netherlands.
- Partiwi, A. 2019. Pengenalan pemicu pemanasan global menggunakan teknologi augmented reality berbasis desktop. *Jurnal Ilmiah Teknologi dan Rekayasa*. 24(1): 46-57.
- Patra, A., T. Park, M. Kim, dan Z. Yu. 2017. Rumen methanogens and mitigation of methane emission by anti-methanogenic compounds and substances. *Journal of Animal Science and Biotechnology*. 13(2017): 1-18.
- Plummer, D. T. 1978. *An Introduction to Practical Biochemistry*. Third Edition. Mc. Graw-Hill Book Company. Publ. New Delhi.
- Popp, A., H. Lotze-Campen, dan B. Bodirsky. 2010. 'Food consumption, diet shifts and associated non-CO2 greenhouse gases from agricultural production. *Global Environmental Change*. 20: 451–62.
- Pratama, R dan L. Parinduri. 2019. Penanggulangan pemanasan global. *Buletin Utama Teknik*. 15(1): 91-95.
- Qiao, J., Z. Tan, dan M. Wang. 2014. Potential and existing mechanisms of enteric methane production in ruminants. *Scientia Agricola*. 71(5): 430-440.
- Scheller, S., M. Goenrich, R. K. Thauer, dan B. Jaun. 2013. Methyl-coenzyme m reductase from methanogenic archaea: isotope effects on the formation and anaerobic oxidation of methane. *Journal of the American Chemical Society*. 2013(135): 14975-14948.
- Septaria, K., B. A. Dewanti, dan M. Habibbulloh. 2019. Implementasi metode pembelajaran spot capturing pada materi pemanasan global untuk meningkatkan kiterampilan proses sains. *Prisma Sanis: Jurnal*

- Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram. 7(1): 27-37.
- Siegbahn, P. E. M., S. Chen, dan R. Liao. 2019. Theoretical studies of nickel-dependent enzymes. *Inorganics*. 7(95): 1-29.
- Sirohi, S. K., P. K. Choudhury, S. S. Dagar, A. K. Puniya, dan D. Singh. 2013. Isolation, characterization and fibre degradation potential of anaerobic rumen fungi from cattle. *Annals of Microbiology*. 63(2013): 1187-1194.
- Spasov, D. 2024. Binding affinity determination in drug design: insights from lock and key, induced fit, conformational selection, and inhibitor trapping models. *International Journal of Molecular Sciences*. 25(13):7124.
- Tapio, I., T. J. Snelling, F. Strozzi, dan R. J. Wallace. 2017. The ruminal microbiome associated with methane emissions from ruminant livestock. *Journal of Animal Science and Biotechnology*. 8(7): 1-11.
- Thiel, A., R. Rümble, P. Mair, H. Yeman, dan P. Beilstein. 2019. 3-NOP: ADME studies in rats and ruminating animals. *Food and Chemical Toxicology*. 125(2019): 528-539.
- United States Environmental Protection Agency. EnviroAtlas. Overview of Greenhouse Gases. Retrieved: October 14, 2021, from <https://www.epa.gov/ghgemissions/overview-greenhouse-gases#methane>.
- Usman, Y. 2013. Pemberian pakan serat sisa tanaman pertanian (jerami kacang tanah, jerami jagung, pucuk tebu) terhadap evolusi pH, N-NH₃ dan VFA di dalam rumen sapi). *Jurnal Agripet*. 13(2): 53-58.
- Van Soest, P. J. 1983. *Nutritional Ecology of the Ruminant*. New York. Cornell University Press.
- Wolin, M. J. 1981. Fermentation in the rumen and human large intestine. *Science*. 213(4515):1463–1468.
- Wongnate, T. dan S. W. Ragsdale. 2015. The reaction mechanism of methyl-coenzyme m reductase: how an enzyme enforces strict binding order. *The Journal of Biological Chemistry*. 290(15): 9322-9334.
- Yang, S. S., C. M. Liu, dan Y. L. Liu. 2003. Estimation of methane and nitrous oxide emission from animal production sector in Taiwan during 1990–2000. *Chemosphere*. 52: 1381-1388.
- Yu, G., K. A. Beauchemin, dan R. Dong. 2021. A review of 3-nitrooxypropanol for enteric methane mitigation from ruminant livestock. *Animals*. 2021(11): 1-16.
- Yusuf, R. O., Z. Z. Noor, A. H. Abba, M. A. A. Hassan, dan M. F. M. Din. 2012. Methane emission by sectors: a comprehensive review of

emission sources and mitigation methods. *Renewable and Sustainable Energy Reviews*. 16(2012): 5059-5070.

Yanuartono, S. Indarjulianto, H. Purnamaningsih, A. Nururrozi, dan S. Raharjo. 2019. Fermentasi: Metode untuk Meningkatkan Nilai Nutrisi Jerami Padi Jurnal Sain Peternakan Indonesia. 14(1): 49-60.

Zijderveld, S. V. 2011. Dietary strategies to reduce methane emissions from ruminant. Wageningen University: Netherlands. 35-36. Acharya, S.N. 2009. Veldt cicer milkvetch. *Can. J. Plant Sci.* 89(3): 511-513.

Zinder, S. H. 1993. Physiological ecology of methanogens. *Methanogenesis: Ecology, Physiology, Biochemistry and Genetics*, ed Ferry JG. Chapman and Hall. New York.